NIGERIAN VETERINARY JOURNAL

ISSN 0331-3026

Nig. Vet. J., December2019 Vol 40(4): 263 - 277

https://dx.doi.org/10.4314/nvj.v40i4.2 **ORIGINAL ARTICLE**

Some Aspects of Reproductive Performance of Red Sokoto Goat Does Post Synchronization with Prostaglandin F_2-Alpha And Progesterone Sponges

Bello, A.A.,[1*] Voh JR. A.A.,[2] Ogwu, D.,[1] Tekdek, L.B[1]

[1]Department of Theriogenology and Production, Faculty of Veterinary Medicine, Ahmadu Bello University Zaria. National Animal Production Research Institute, Shika, Ahmadu Bello University Zaria..
[2]Department of Theriogenology and Production, Faculty of Veterinary Medicine, Ahmadu Bello University Zaria. Department of Medicine, Faculty of Veterinary Medicine, Ahmadu Bello University Zaria.
*Corresponding author :adehabello@abu.edu.ng, Mobile:+ 234 803 615 348 3

SUMMARY

A study on reproduction of 52 Red Sokoto Goat (RSG) does was conducted to evaluate some aspects of their reproductive performance for clinical application and as an update. Does were randomly divided into 18, 18 and 16 as prostaglandin F_2-alpha ($PGF_2\alpha$), progesterone sponges (P_4S) and control groups respectively. Double injection protocol of $PGF_2\alpha$, 12-days apart, and P_4S inserted for 12-days were used to synchronize oestrus, while the control group received no treatment. Thirteen bucks were used, seven as breeders and six as heat detectors. Oestrus detection employed visual observation and apronisation. Standing to be mounted was the cardinal sign of oestrus. Breeding was by hand-mating and at detected oestrus. Results indicated heterosexual and homosexual mounting, thin stringy clear mucous discharge and standing-to-be-mounted as signs of oestrus**.** Oestrus response rate was 100 %, 94.4 % and 75.0 % for $PGF_2\alpha$, P_4S and Control respectively; P_4S retention rate was 94%. Effect of synchronization agent on on-set of oestrus was 15.86 $\pm$ 0.73 h ($PGF_2\alpha$), 15.08 $\pm$ 0.84 h (P_4S) and 17.73 $\pm$ 0.85 h (Control), while parity on on-set of oestrus was 12.12 $\pm$ 1.87 h (first), 17.77 $\pm$ 0.77 h (second) and 18.79 $\pm$ 1.95 h (third). Effect of synchronization agent on duration of oestrus was 44.76 $\pm$ 2.13 h, 45.78 $\pm$ 2.46 h and 42.40 $\pm$ 2.50 h for $PGF_2\alpha$ P_4S and Control respectively, while parity on duration of oestrus was 42.26 $\pm$ 5.48 h (first), 45.02 $\pm$ 2.27 h (second) and 45.67 $\pm$ 5.73 h (third). There were no significant differences ($P > 0.05$) for oestrus on-set and duration. Overall pregnancy and conception rates were 65.4 % and 72.3 % respectively, kidding rate was 76.5 %, abortion rate was 23.5 % and late embryonic mortality rate was 26.5 %. Mean gestation were 146.29 $\pm$ 1.59 and 146.63 $\pm$ 1.64 for single and twin births respectively. Age, parity and body condition score of dam had significant effect on litter size ($P < 0.05$). It was concluded that some aspects of the reproductive performance of the RSG does studied following oestrus synchronization with $PGF_2\alpha$ and P_4S had clinical application, good and acceptable.

Key Words: Reproductive, Red Sokoto, Does, Prostaglandin F_2-alpha and Progesterone.

INTRODUCTION

Reproductive performance and characteristics of goats is a fundamental factor in increasing productivity. Good understanding of the traits and generation of such data as influenced by genetic, environmental and technological factors are essential in enhancing their reproductive potentials and performance (Chiboka *et al.,* 1988; Akpa *et al.,* 2004). Oestrus synchronization is an effective method of improving reproductive efficiency in livestock for faster genetic improvement, multiplication, and demarcation of breeding season (Voh Jr., 1996). Oestrus response to synchronization agents is reportedly affected by season, age, breed, stage of oestrus cycle, nutrition, brand and dosage of synchronizing agent (Voh Jr., 1996; Alemede and Fasanya, 1999; Kusina *et al*., 2000; Wildeus, 2000). It appears there are few reports available on reproductive performance of goats generally and the RSG in particular. More investigations need to be carried on the different aspects of goat production. Hence, this investigation was designed to study some aspects of reproductive performance of the RSG does following synchronization with $PGF_2\alpha$ and P_4S to add to the existing data on reproductive performance of RSG and goats generally for clinical application in the field and as an update.

MATERIALS AND METHODS

The location and period of study

The study was carried out at a facility of the National Animal Production Research Institute, Shika, Ahmadu Bello University Zaria. Shika is located between latitudes 11^o N and longitude 12^o E at an altitude of 640 m above sea level with an average annual rainfall of 1100 mm. Daily temperature ranges from 14^o C to 30^o C, with relative humidity of 21 % during the harmattan. The average temperature and humidity during the wet season are 25^o C and 72 % respectively. Shika is 22 km northwest of Zaria in the northern guinea savannah zone of Nigeria (Buvanenedran *et al.,* 1981; Oyedipe *et al.,* 1982 and Malau-Aduli *et al.,* 1996). The study was carried out during the harmattan period between October and March.

Experimental Animals, Housing and Management

A total of 65 Red Sokoto Goats (RSG) were used for the study and housed in an aluminum roofed pen linked to a chain and link open fence section, where only does were kept. Animals were fed with Metabolizable Energy (ME) of 11.68 mJ/Kg DM and 15 % CP. The feed was compounded using maize (*Zea mays*), maize offal, wheat offal and cotton seed cake, and 50:50 ratio of hay (*Digitaria smutsi*) to concentrate. Salt was added at 2 %. Concentrate was fed in the morning (8 – 10 am) and evening (4 – 6 pm) while hay and water were provided *ad-libitum.* Pre-experimental period of three months was used to determine cyclicity of does before animals were finally selected for the experiment. Ballottement for detection of pregnancy, body condition score (Pullan, 1978), age (Records; Dentition - Clair, 1975) and parity were used to select 52 RSG does and 13 bucks for the study. The does were made up of 30 adult (1 to 2 parities) and 22 maiden does. The does had an average weight of 21.7 kg (range: 12 - 43 kg), BCS of 3.2 (range: 2.5 – 4.0) and ages were grouped as less or equal to 12, 13 to 18, 19 to 24, 25 to 30, 31 to 36 and 37 to 42 months. Seven matured bucks were selected for breeding, while six were apronised

for oestrus detection. The bucks had an average weight of 21.5 kg, BCS of 3.5 and age of 18 months.

Animal Grouping and Treatment

Does were randomly assigned to three groups: $PGF_2\alpha$, P_4S and Control. Groups were assigned to their specific pens and maintained throughout experimental period. Each groups had two apronised bucks for heat detection. Breeder bucks were kept separately in different pen and used during breeding. Treatments of does for oestrus synchronization were done with $PGF_2\alpha$ (*Dinoprost tromethamine – Lutalyse®, New York, US)* and P_4S for their respective groups while no treatment administered to Control group. Treatment of $PGF_2\alpha$: double injection, 12-days apart protocol was employed, at 12.5 mg per animal deep intra muscular injection. Progesterone sponges containing 30 mg Cronolone (*Florogestone Acetate, Intervet Company, France*) was used for P_4S group. The sponges were inserted into the vagina using an applicator following lubrication with slipiel lubricant (*Intervet Company, France*) on day one of the experiment and remained intravaginal for 12 days before removal.

Oestrus detection, Breeding and Pregnancy diagnosis

Apronised bucks and visual observation were employed in oestrus detection. Two bucks were introduced to each group on day 1 of commencement of the experiment and maintained throughout the experimental period. Heat detection was intensive and non-intensive. Intensive heat detection was done continuously for 168 hours after each $PGF_2\alpha$ injection and P_4S withdrawal. Non-intensive was for four hours (8 – 10 am and 4 - 6 pm) daily whenever the intensive ended. Breeding was by hand mating following the second $PGF_2\alpha$ injection and P_4S withdrawal and the male remained with the female for 24 to 48 hours. Blood samples (5 ml) were collected via venipuncture from the jugular vein using vacutainer tubes. The blood samples were taken on day 21 post breeding in all groups for pregnancy diagnosis, and subsequently taken to the laboratory for immediate serum separation and assayed for progesterone. The 'Coat-A-Count' progesterone kit (Diagnostic Products Corporation, Los Angeles, U.S.A)® Supplied by FAO/IAEA was used to assay for serum progesterone. It is a no-extraction solid phase 125I-progesterone radioimmunoassay (RIA) technique. Detection of progesterone concentration of $\geq$ 0.5 ng/ml in a bred doe was considered pregnant.

Data Collection and Analysis

Age, parity, body condition score, behavioural oestrus signs, oestrus response, oestrus on-set, oestrus duration, repeat oestrus, pregnancy, conception, embryonic mortality, abortion, kidding, litter size, weight of kid, sex of kid and gestation data were recorded. Data were analysed using SAS (Statistical Analysis System, 1987) system, the General Linear Model and Mean Procedure.

RESULTS

Behavioural signs, on-set and duration of oestrus, Oestrus response rate and Progesterone sponges retention rate

Behavioural signs of oestrus: continuous wagging of tail and bleating, restlessness, coming together and guarding each other, oedematous and reddened vulva, urination posture and frequent urination, moving away when mounting was attempted, homosexual mounting, heterosexual mounting, exhibition of flehmen, thin clear stringy glossy mucous discharge and standing-to-be-mounted. Does in oestrus often went-off feed especially as they stand-to-be-mounted and split oestrus (oestrus with breaks of hours or days in-between) in some does with two or three days in-between the split. Interval from end of treatment to on-set of oestrus for synchronization agent was 15.86 $\pm$ 0.73 h, 15.08 $\pm$ 0.84 h, and 17.73 $\pm$ 0.85 h for $PGF_2\alpha$, P_4S and Control groups respectively, while parity had 12.12 $\pm$ 1.87 h, 17.77 $\pm$ 0.77 h and 18.79 $\pm$ 1.95 h for first, second and third parities respectively. These showed no significant differences ($P > 0.05$) (Table I and IV). Duration of oestrus for synchronization agent was 44.76 $\pm$ 2.13 h, 45.78 $\pm$ 2.46 h, and 42.40 $\pm$ 2.50 h for $PGF_2\alpha$, P_4S and Control groups respectively, while parity had 42.26 $\pm$ 5.48 h, 45.02 $\pm$ 2.27 h and 45.67 $\pm$ 5.73 h for first, second and third parities respectively. These showed no significant difference ($P > 0.05$) **(**Table I and IV**).** Oestrus response rate for $PGF_2\alpha$ group was 100 %, P_4S had 94.4 % and spontaneous oestrus for Control group was 75.0 % **(**Table I**).** P_4S retention rate was 94% and non-retention rate was 5.6 %**.**

Repeat Oestrus, Repeat Breeder and Embryonic Mortality

A total of 20 (38.5 %) oestri were repeated by 14 does, with 14 (27 %) oestri repeated once, 4 (7.7 %) repeated twice, 1(1.9 %) repeated trice and 1(1.9 %) repeated four times. The does were re-bred at each repeat oestrus. Repeat Breeder Rate was 1.9%**.** Late Embryonic Mortality Rate was 26.4 % **(**Table II**).**

Pregnancy, Conception, Kidding and Abortion Rates Pregnancy rates were 55.6 %, 72.2 % and 68.8 % for $PGF_2\alpha$, P_4S and Control groups and corresponding conception rates were 55.6 %, 76.5 % and 91.7 % respectively. Overall pregnancy and conception rates were 65.4 % and 72.3 % respectively **(**Table I**).** Kidding rate was 76.5 %. Single and twin kidding rates were 73.1% and 26.9 % respectively. Abortion rate was 23.5 % **(**Table V**).**

Effect of Litter Size and Sex of Kid on Gestation; and of Age of Dam, Parity and Body Condition Score on Litter Size, Weight of Kid and Gestation

Mean gestation were 146.29 $\pm$ 1.59 and 146.63 $\pm$ 1.64 for single and twin births respectively, while gestation for male foetus was 147.57 $\pm$ 1.72 days and female foetus was 145.41 $\pm$ 1.37 days. There was no significant difference ($P > 0.05$) (Table VI).

TABLE I: Summary of fertility rate of Red Sokoto goat does in $PGF_2\alpha$, P_4S and control groups

Animal Group.	Parameters				
	Oestrus on-set (Hours)	Oestrus duration (Hours)	Oestrus Response Rate (%)	Pregnancy Rate (%).	Conception Rate (%).
Prostaglandin F_2-alpha ($PGF_2\alpha$); n=18	15	44	100	55.55	55.55
Progesterone sponges (P_4S); n=18	15	45	94.4	72.22	76.47
Control; n=16	17	42	75.0	68.75	91.66

TABLE II: Repeat oestrus and repeat breeder rates following oestrus synchronization with $PGF_2\alpha$ and P_4S in Red Sokoto goat does.

Treatment Group.	Repeat Oestrus.					
	Number of animals in a group.	Number of Animals				Total.
		First	Second	Third	Fourth	
Prostaglandin F_2-alpha ($PGF_2\alpha$).	18	7	2	0	0	9
Porgesterone Pessaries (P_4 S)	18	4	2	1	1	8
Control.	16	3	0	0	0	3
Total	**52**	**14 (27.0%)**	**4 (7.7%)**	**1 (1.9%)**	**1 (1.9%)**	**20 (38.5%)**

TABLE III: Embryonic mortality rate estimated by delayed return to oestrus rate method and comparative distribution of oestrous cycle for normal and repeat breeder does of Red Sokoto goat does.

Oestrous cycle length category (Days).	Repeat Oestrus.					
	Interpretation.	First	Second	Third	Fourth	Total.
8 – 9 (3 - 7)	Genuinely short cycle.	6	1	0	0	7
< 8 or 10 - 16	Luteal insemination/ Natural service.	0	0	0	0	0
17 - 24	Normal cycle.	1	1	0	1	3
25 – 36 or > 45	Embryonic loss.	5	4	0	0	9 (26.4%)
37 – 45	Non-detected oestrus or silent heat.	1	0	0	0	1
	Total	13	6	0	1	20

TABLE IV: Effect of synchronization agents and parity on on-set and duration of oestrus in Red Sokoto goat does.

Parameters	Oestrus	
	On-set (Hours) Mean + S.E.	Duration (Hours) Mean + S. E.
Synchronization Agents:		
Prostaglandin F_2 alpha	15.86 ± 0.73^a	44.76 ± 2.13^a
Progesterone pessaries	15.08 ± 0.84^a	45.78 ± 2.46^a
Control	17.73 ± 0.85^a	42.40 ± 2.50^a
Parity:		
First	12.12 ± 1.87^a	42.26 ± 5.48^a
Second	17.77 ± 0.77^a	45.02 ± 2.27^a
Third	18.79 ± 1.95^a	45.67 ± 5.73^a

TABLE V: Summary of kidding / litter size rates of Red Sokoto goat does in $PGF_2\alpha$,P_4S and Control groups

S/N	Parameters	Number/Percentages
1	Total number of animals	52
2	Pregnant animals	34
3	Kidding	26 (76.5 %)
3	- Single birth	19 (73.1%)
4	- Twin birth	7 (26.9%)
5	- Triplet birth	0 (0.0%)
6	- Quadruplet birth	0 (0.0%)
7	Abortions	8 (23.5%)
9	Gestation (days)	141 – 152 (148)

TABLE VI: Mean ± S.E. of the effect of litter size and sex of kid on gestation period of Red Sokoto goat does.

Parameters (Factors).	Gestation Period (GP) (Days).
Litter Size (LS):	
- Single Birth	146.29 ± 1.59
- Twin Birth	146.63 ± 1.64
Sex of kid (SK):	
- Male	147.57 ± 1.72
- Female	145.41 ± 1.37

Means square of age of dam for weight of kid, sex of kid and gestation were 0.70, 0.26 and 6.04 respectively, and corresponding values for parity were 0.60, 0.01 and 36.52. Age of dam (1.17) and parity of dam (1.28) had significant effect ($P < 0.05$) on litter size. (Table VI**I).** Mean ± S.E. of first, second and third parities for litter size, weight of kid, sex of kid and gestation were 2.01 ± 0.31, 1.19 ± 0.61 and 1.56 ± 0.35 (litter size), 1.34 ± 0.11, 1.16 ± 0.06 and 0.94 ± 0.12 (weight of kid), 1.44 ± 0.29, 1.73 ± 0.16 and 1.70 ± 0.33 (sex of kid) and 144.96 ± 3.92, 144.91 ± 2.07 and 149.66 ± 4.39 (Gestation). Parity had significant effect ($P < 0.005$) on litter size (Table VII**).** Age group of dam Mean ± S.E. of ≤ 12, 13 to 18, 19 to 24, 25 to 30, 31 to 36 and 37 to 42 months for litter size, weight of kid, sex of kid and gestation obtained were: 1.00 ± 0.20, 1.67 ± 0.15, 1.67 ± 0.26, 1.22 ± 0.15, 1.80 ± 0.20 and 2.60 ± 0.20 (litter size), 1.22 ± 0.08, 1.18 ± 0.62, 1.03 ± 0.11, 1.21 ± 0.06, 1.18 ± 0.08 and 1.10 ± 0.08 (weight of kid) and 144.60 ± 3.00, 147.22 ± 2.34, 146.67 ± 3.88, 145.44 ± 2.24, 149.20 ± 3.00 and 144.60 ± 3.00 (Gestation). Age group of dam had a significant effect ($P<0.05$) on litter size (Table VII**).** Body condition score (BCS) Mean ± S.E.: Good BCS were 1.58 ± 0.15 (litter size), 1.13 ± 0.05 (weight of kid) and 146.32 ± 1.63 (Gestation); Very Good BCS were 1.65 ± 0.16 (litter size), 1.22 ± 0.05 (Weight of kid) and 146.17 ± 1.75 (Gestation). Body condition score had significant effect ($P<0.05$) on litter size (Table VII).

DISCUSSION

Oestrus Behaviour

Behavioural signs of oestrus exhibited and observed in both treatment groups were typical of the species and consistent (Molokwu and Igono, 1978**;** Akusu, 2003). Similar findings were reported in the same breed (Jatau, 2002) and West African Dwarf Goat (Akusu, 2003). Heterosexual and homosexual mounting, a useful behavioural sign of oestrus in oestrus detection, especially in silent oestrus, was particularly demonstrated as in the bovine (and other ruminants), but homosexual mounting, however , was very minimal as earlier noted and reported by Jatau (2002). This seems to affirm the limited

TABLE VII: Mean ± S. E. of the effect of age group of dam, parity of dam and bodycondition score on litter lize, weight of kid, sex of kid and gestation period of Red Sokoto goat does.

Parameters.	Mean ± S. E.			
	Litter Size (LS).	Weight of Kid (WK). (Kg)	Sex of Kid (SK).	Gestation Period (GP). (Days)
Age Group of Dam (AGD):				
- Less than or equal to 12 Months (≤ 12 Months).	1.00 ± 0.20[c]	1.22 ± 0.08[a]	-	144.60 ± 3.30[a]
- 13 to 18 Months.	1.67 ± 0.15[b]	1.18± 0.62[a]	-	147.22 ± 2.34[a]
- 19 to 24 Months.	1.67 ± 0.26[b]	1.03 ± 0.11[a]	-	146.67 ± 3.88[a]
- 25 to 30 Months.	1.22 ± 0.15[b]	1.21 ± 0.06[a]	-	145.44 ± 2.24[a]
- 31 to 36 Months.	1.80 ± 0.20[b]	1.18 ± 0.08[a]	-	149.20 ± 3.00[a]
- 37 to 42 Months.	2.60 ± 0.20[a]	1.10 ± 0.08[a]	-	144.60 ± 3.00[a]
Parity of Dam (PD):				
- First.	2.01 ± 0.31[a]	1.34 ± 0.11[a]	1.44 ± 0.29[a]	144.96 ± 3.92[a]
- Second.	1.19 ± 0.61[b]	1.16 ± 0.06[a]	1.73 ± 0.16[a]	144.91 ± 2.07[a]
- Third.	1.56 ± 0.35[b]	0.94 ± 0.12[a]	1.70 ± 0.33[a]	149.66 ± 4.39[a]
Body Condition Score (BCS):				
- Good	1.58 ± 0.15[b]	1.13 ± 0.05[a]	-	146.32± 1.63[a]
- Very Good	1.65 ± 0.16[a]	1.22 ± 0.05[a]	-	146.17 ± 1.75[a]

value of homosexual mounting in oestrus detection of does, which has often found better practical application in the cow. Therefore, heterosexual behaviour, where in the presence of the buck, psychic oestrus manifestation was clear, vigorous and district, may be of interest and advantage, and be further investigated. The clinical significance of heterosexual mounting in oestrus detection in this species as evidenced from previous reports and confirmed in this study should be utilized in the field. This may detect 95 – 100 % does in oestrus. Standing to be mounted, as a cardinal sign of oestrus was obvious and is what a breeder should watch out for during breeding programs in the field. Bucks were noted to have 3 to 5 mounting in 2 to 3 minutes with a distinctive ejaculatory thrust in such mountings. The mounting frequency within short time especially with an ejaculatory thrust indicates high libido and is of interest clinically

Generally, activities of behavioural signs of oestrus were observed not to be very elaborate and were attributed to the sudden cold weather that was intense during the observation period. Hence, cold weather may be considered among other factors when planning for similar studies.

Oestrus On-set and Duration

The interval from second $PGF_2\alpha$ injection and P_4S withdrawal to onset of oestrus was shorter in P_4S than $PGF_2\alpha$ and the difference was not significant ($P > 0.05$). Both agents induced oestrus two hours earlier than the control group. This is similar and in agreement with earlier

reports in the breed (Ogunbiyi *et al.,* 1980; Kawu 2011; Bello, 2011; Omontese *et al.,* 2012; Omontese *et al*., 2013b; Omontese *et al.,* 2014) and other breeds **(**Romano, 1998**;** Akusu, 2003). Reports on the effect of prostaglandin ($PGF_2\alpha$) on oestrus on-set have been variable. Omontese *et al.* (2014) used $PGF_2\alpha$ and recorded 32 h but in another experiment $PGF_2\alpha$ in combination with equine chorionic gonadotrophin recorded 29 h. Akusu (2003) using different doses (5mg and 10mg) in WAD reported 48 h and 54 h respectively, and in another work reported 46 to 48 h respectively in dairy goats, while Romano (1998^b) used similar doses reported 60 h and 48 h respectively in Nubian does. These values are higher than the value obtained in this study. Reports on effect of progesterone (*Florogestone Acetate* - FGA)) on oestrus on-set are also variable. Comparing different FGA and MAP treatments for 12 and 14 days, Romano (1996) reported 41 h and 53 h (FGA) while 49 h and 45 h (MAP) in Nubian dairy goat, while 32 h in a similar experiment (Romano 1998). These values are higher than the value obtained in this experiment. The reason for lower values obtained in this study is not clear, but may be attributed to breed differences. The cold weather during the experiment was also thought to be responsible, such that synthesis of hormones necessary for manifestation of behavioural oestrus (Akusu, 2003) was affected, hence, detectors could not notice the oestrus on-set early enough and appropriately. This appear to be adducible following oestrus in a doe that was only detected hormonally (progesterone assay), which eluded probably both detectors and apronized bucks. This perhaps highlights the significance of more investigation into additional methods of oestrus detection. On-set was earlier in does with first parity and results further showed that on-set increase as parity increases. This may have some practical implication on oestrus detection and artificial insemination (AI) especially in timed AI if finding is confirmed and established.

Duration of oestrus obtained in both treatments in this study is similar and in agreement with ranges reported by different authors in the breed (Ogunbiyi *et al.,* 1980; Kawu 2011; Bello, 2011; Omontese *et al.,* 2012; Omontese *et al*., 2013b; Omontese *et al.,* 2014) and in other breeds of goats (Romano, 1996; Akusu, 2003) and the results showed that duration was not affected by treatment ($P > 0.05$). Akusu (2003) in different experiments with $PGF_2\alpha$ reported durations of values of 20 to 48h in West African Dwarf goat. Romano (1996) using progesterone reported 30 to 36h in Nubian goat. The Kabing Kajang goat, Saanen goat and Pygmy were reported to have 10 to 62h, 6 to 144h and 96h respectively (Akusu, 2003). Oestrus duration was shortest in does with first parity and results further showed increase in duration of oestrus as parity increased.

The beneficial practical application of oestrus on-set and duration during oestrus synchronization in does is to separate and synchronize does by parity if possible. This may enable breeding of does with early oestrus on-set and shorter duration earlier (first parity) while other parities bred subsequently.

Progesterone Sponge Retention Rate

Progesterone sponge retention rate of 94 % obtained was very good and acceptable and similar to the reports of Omontese *et al*. (2010), Bello, (2011), Omontese *et al*. (2013b) and who reported 100%, 94 %, 56 % and 94.4 % respectively in the same breed and 100% (Romano, 1996) in other breed Differences in protocol employed, intravaginal sponge texture

and consistency (Alifakiotis *et al*., 1982), length of vaginal tract (Omontese *et al*., 2013b) and techniques employed in inserting the sponge (Romano, 1998) may explain differences in values obtained for sponge retention. The lost sponge did not affect synchronization. The doe that lost the sponge however came on heat and was bred, and eventually kidded normally without any help. The study therefore showed that the doe that lost its sponge was able to exhibit fertile oestrus. This seems to suggest that loss of sponge may not affect fertility however depending on the stage of the treatment at which the sponge is lost.

Oestrus Response

The oestrus response rate for $PGF_2\alpha$ obtained was in consonance with findings reported locally and in the breed (Ogunbiyi *et al.*, 1980; Alemede and Fasanya, 1999; Jatau, 2002; Voh Jr. *et al*., 2003; Akusu, 2003; Omontese *et al*., 2010; Bello, 2011; Omontese *et al*., 2013b; Omontese *et al.*, 2014; Bello *et al.*, 2019) and those elsewhere (Wildeus, 1999; Kusina *et al.*, 2000, Pierson *et al.*, 2001; Medan *et al.*, 2002 and, Whitley and Jackson, 2004). Similarly, oestrus response rate for progesterone sponges was in agreement with those reported before (Romans, 1996; 2002; Whitley and Jackson, 2004; Omontese *et al*., 2010; Bello, 2011; Omontese *et al*., 2013b; Bello *et al.*, 2019). The 77.78 and 100 % ($PGF_2\alpha$) recorded for the double injection protocol were higher than the 70 and 75% (Alemede and Fasanya, 1999), 75 and 92.9% (Jatau, 2002) for first and second injection of $PGF_2\alpha$ respectively, and for single injection was 50 - 90 % (Omontese *et al*., 2013b) and 78.6 % (Omontese *et al*., 2014) reported in the same breeds. In Kano brown, Ogunbiyi (1990) reported 64 and 84% for the same protocol. Elsewhere, percentages are variable for $PGF_2\alpha$ and progesterone, and ranged from 13 to 100% for $PGF_2\alpha$ and, 0 to 100% for progesterone, with or without co-treatments, in different breeds and seasons, and compares with the 94.40% progesterone sponges obtained in this study. Breed, dosage, season, co-treatment and brand influence oestrus response and these may be responsible for the differences obtained.

In the field, where $PGF_2\alpha$ and progesterone sponges are considered among other factors, this study implies preference to $PGF_2\alpha$ as agent of interest as reported by Bello *et al.*, 2019.

Effect of Synchronization agents and Parity on On-set and Duration of Oestrus

Progesterone shortened on-set and prolonged duration of oestrus, and similar effect was observed with $PGF_2\alpha$. Contrast between the agents indicated that $PGF_2\alpha$ took longer time relatively to initiate oestrus than progesterone, while oestrus duration lasted longer with progesterone than $PGF_2\alpha$. However, $PGF_2\alpha$ and progesterone sponges had no significant effect ($P>0.05$) on both the on-set and duration of oestrus. Findings agree with reports in the breed (Bello, 2011; Omontese *et al*., 2013b; Omontese *et al.*, 2014). This may suggest the need for specific consideration when individual agent is used in oestrus synchronization on both on-set and duration. However, results indicate both agents had advantage of inducing oestrus earlier and duration of oestrus lasting longer than the spontaneous oestrus (Table I and IV).

On-set was earlier in does with first parity and its corresponding duration was shortest, however, parity had no significant effect ($P > 0.05$) on both oestrus on-set and duration. Results further showed that on-set and duration of oestrus

increased as parity increased, and this agrees with report of Bello (2011). This trend seems to be implicative and calls for caution during oestrus detection and breeding especially when artificial insemination or natural breeding among does in the breed is desired (Table I and IV).

Embryonic mortality and Repeat breeder

The 26.4% embryonic mortality (EM) rate estimated by delayed return to heat in this report was also high, particularly with respect to the number of animals used in the study. Planned slaughter after breeding and progesterone concentration methods have been employed to study EM other than the delayed return to oestrus method (Voh Jr., 1996; Bello, 2011). Although planned slaughter is expensive and impractical under field conditions, it has however, given the most reliable information about the nature of EM (Voh Jr., 1996). Considering the reproduction of the does, 7 does had short cycle had a ranging from 3 to 7 days which is in agreement with the report of Akusu (2003) in West African Dwarf Goat (WADG) where less than 15 days was reported. The 3 does with normal cycle or medium (17 to 24 days) and the 9 does with embryonic loss or long cycle equally agrees with the report of Akusu (2003) indicating similar occurrence in Red Sokoto goat.

The incidence rate of 1.9% of repeat breeder was high especially considering the number of the animals used in the study. The 27.0 and 7.7% for the first and second repeats of oestrus was also high which ranged from 3 to 61 days, which are similar to Bello (2011). The reasons for this observation was not clear but possibly due to the cold weather which could physiologically interfere with active sexual activities in both sexes, ejaculation and sperm mortality (Akusu, 2003). It may also be due to the resorption of an early pregnancy which is a common phenomenon in a small percentage of early pregnancy in goat, especially in a flock subjected to oestrus detection by teaser bucks even after conception (Kutty, 1999).

It is generally considered that an increase in the interval between service and return to oestrus beyond the usual range of 17 to 24 days reflect EM (Voh Jr., 1996). Some of the causes and or factors that may influence EM and **repeat breeder (**RB) include genetic, nutrition, age, climate, infection, semen quality, hormonal imbalance and uterine environment (Voh Jr., 1996). Since EM occurring between 6 to 16 days cannot be estimated by delayed return to oestrus, coupled with the fact that most embryonic losses occur during this period, it is imperative to make the distinction between early embryonic mortality (EEM) and late embryonic mortality (LEM). What has been estimated in this study was LEM. Consequently, if EEM and LEM were investigated, the embryonic mortality rate would be a lot higher than what has been reported. This study has attempted to confirm the existence and to some level the extent of EM and RB syndrome in naturally serviced Red Sokoto Goat does. More detailed research work is needed to delineate more clearly the extent and economic importance of EM and RB syndrome to enable appropriate clinical field application.

Pregnancy and Conception rates

The overall pregnancy and conception rates (PR and CR) of 65.4 and 72.3% respectively, and the specific group pregnancy and conception rates observed, were within the acceptable ranges and in agreement with earlier reports which were variable (Smith, 1995; Bello, 2011 Leethongdee and Ponglowhapan, 2014; Farin, 2015; Anghel, *et al.*, 2016).

Abortion and Kidding rates

Kidding rate (76.5%) obtained had most of the births as singles (73.1%) with few twin births (26.9%). No triplet and quadruplet births were recorded in this study. The kidding rate observed was high even though it was less than the 175% reported by Adu *et al.,* (1980) over the 5 year study period and similar to Bello (2011) in the breed, and other breeds (Leethongdee and Ponglowhapan, 2014; Farin, 2015; Anghel, *et al.,* 2016), and the breed ranked among the most prolific breed of goats. The overall abortion rate (23.5%) was high even though goats are known for high incidence of abortion. This might have been caused by handling among other factors such as infectious diseases such as brucellosis in the flock which was diagnosed earlier (verbal communication). Litter type differed from reports of Akusu (2003) in WADG who reported lower (27.0%) percentage for singletons, higher (57.0%) percentage for twinning, 13% and 3% for triplets and quadruplets respectively.

Effect of Litter size and Sex of kid on Gestation

Litter size and sex of kid had no significant effect ($P > 0.05$) on gestation. Twin birth had relatively longer gestation period than singletons. This differed with report of Akusu (2003) in WADG where singletons had longer gestation length than twin and triplets births and similar to Bello (2011) in the breed. Does with male kids off-springs in this study had relatively longer gestation period than does with female kids. Similarly, this also differed with Akusu (2003) where female kids had longer gestation in WADG. The gestation period obtained agrees with the reported range of 144 to 155 days (average 150 days) (Amoah, 1996; Wildeus, 2008). The average gestation of 146.5 (range 144 to 149 days) differed with the 142 days and 149 days reported for RSG and WADG by Akpa *et al.,* (2004), and 144.90 days for WADG by Akusu (2003). Uterine stretch has been noted to be an important factor in parturition (Akusu, 2003) and hence may be responsible for the differences between does with male and female offsprings as well as singletons and twinning gestation lengths and the determinants for the uterine stretch may be the same.

Results further showed that age of dam (age group of dam), parity and body condition score (BCS) had a significant effect ($P <0.05$) on litter size, but no effect ($P > 0.05$) on weight of kid, sex of kid (parity only) and gestation period. This finding was in agreement with the reports of Amoah *et al.,* (1996) for weight and Akpa *et al.,* (2004) for parity, where litter size equally affected breed and season, and similar to Bello (2011) in the breed. The average litter size of 1.63 was higher than the 1.45 reported by Adu *et al.,* (1980) but lower than 1.7 and 2.0 reported by Otchere *et al.,* (1993) and Akpa *et al.,* (2004) respectively, in the same breed. In this study, results showed that litter size increased with increased age group of dam and body condition score, but decreased with increased parity. The average weight of kids 1.16, sex of kid 1.62 and gestation period of 146.5 days were all within the normal ranges reported. However, Akpa et al., (2004) reported increased litter size with increase in parity. The results of this study tend to suggest that as does grow older and gain more weight, higher litter size may be expected rather than parity, (at least in this report). It may therefore be of benefit to consider such in breeding programmes, however, further investigation is needed for establishment.

CONCLUSION

It was concluded that standing-to-mounted, heterosexual mounting, response to synchronization agent, progesterone sponge retention rate, oestrus on-set and duration and parity of does as indices of some aspects of the reproductive performance of the RSG studied had clinical application, above average, good and acceptable. Litter size increased with increasing age group of dam and body condition score but decreased with parity in RSG does.

AKNOWLEDGEMENTS

The Director, National Animal Production Research Institute, Shika, Ahmadu Bello University Zaria, for permission to carry out the work.

REFERENCES

ADU, I. F., BUVANENDRAN, V. and LAKPINI, C. A. M. (1980). Highlights of sheep and goat research at NAPRI, Shika. *A paper presented at Veterinary and Livestock Continuing Education Workshop, A. B. U. Zaria.* 159 – 173.

AKPA, G. N., JOKTHAN, G. E., OGUNLEYE, K. O. and LAKPINI, C. A. M. (2004). Genetic and non-genetic sources of variation for litter size, gestation length, and sex ratio in Nigerian goats. *Journal of Sustainable Tropical Agricultural Research.* 12: 66 - 70.

AKUSU, M. O. (2003). Reproductive performance of goats for maximum animal production in Nigeria. *Inaugural Lecture, 2002/2003, University of Ibadan Nigerian.*

ALEMEDE, I. C. and FASANYA, O. O. A. (1999). Prostaglandin F_2-Alpha (PGF_2-Alpha) as an agent in improving reproductive activities in the Savannah brown doe. *Zaria Agricultural Journal,* 1 & 2: 33 - 37.

ALIFAKIOTIS, T., MICHAILIDIS, I. and GAVNHDIS, G. (1982). Induced breeding in anoestrous milking ewes on dairy breed: Comparison of norgestomet medroxyprogesterone and fluorogestone in two regimes of PMSG. *Theriogenology*, 17: 603-610.

AMOAH, E. A., GELAYE, S., GUTHRIE, P. and REXROAD JR., C. E. (1996). Breeding season and aspects of reproduction of female goats. *Journal of Animal Science.* 74: 723 – 728.

ANGHEL, A., NADOLU, D., ANGHELESCU, C. and SONEA, C. (2016). Artificial insemination of carpathian goats with semen preserved in different forms. *The Annals of "Valahia" University of Targoviste – 2016.* DOI: 10.1515/agr-2016-0004

BELLO, A. A. (2011). Characterization of oestrus, endocrine events and fertility in Red Sokoto goat following comparative oestrus synchronisation with prostaglandin and progestagen. *M. Sc. Thesis.* Ahmadu Bello University, Zaria.

BELLO, A. A., VOHVJR, A. A., OGWU, D. and TEKDEK, L. B. (2019). Oestrus synchronization in Red Sokoto does treated with prostaglandin $F_2\alpha$ and progesterone pessaries. *Sokoto Journal of*

Veterinary Science, 17(2): 65 – 68. *http://dx.doi.org/10.4314/sokjvs.v17i2.9*

BAGLEY, M. N. and DOUG, T. (2006). Meat goat breeders, breeding management, and 4-H market. In: *Goat Management*., 1 – 8.

BUVANENDRAN, V. and NURU, S. (1981). Dairy cattle breeding policy and programmes at N.A.P.R.I. *National Animal Production Research Institue Bulletin.* 5: 6 - 30.

CLAIR, L. E. (1975). " Permanent teeth". In: *Anatomy of the domestic animals*. Edited by Sissian and Company, 866 - 873.

CHIBOKI,O., SOMADE, B. and MONTSMA, G. (1988). Reproductive performance of WAD goat: A summary of research work at Ile-Ife. In: Goat Production in Humid Tropics. *Proceedings of a Workshop at University of Ile-Ife.* Smith, O. B. and Bosman, H. G. (Ed), 125 – 136.

F.A.O. (FOOD AND AGRICULTURAL ORGANIZATION OF UNITED NATION) (1997). *F.A.O. production year Book*, 1996.Vol.50,F.A.O., Rome.

FARIN, C. E. (2015). Artificial insemination and embryo transfer in goats. https://meatgoats.ces.ncsu.edu/wp-content/uploads/2015/10/Goat-AI-ET.pdf?fwd=no

JATAU, J. D. (2002). Oestrus response and conception rate of Red Sokoto goats following oestrus synchronisation with prostaglandin F2-alpha. *H.N.D. Thesis.* National Veterinary Research Institute, Vom, Pleateau State, Nigeria.

KAWU, M.U. (2011). Influence of season on prostaglandin F2α induced oestrus synchronization, profiles of endocrine and serum metabolites during the oestrouscycle in Savannah Brown goats. *P h D Thesis,* Ahmadu Bello University, Zaria.

KUSINA, N. T., TARMIRA, HAMUDIKUWANDA H., AGUMBA, G. and MUKWENA, J. (2000). A comparison of the effects of progesterone sponges and ear implants, PGF_2-alpha and their combination an efficacy of estrus synchronization and fertility of Mashona goat does. *Theriogenology.* 53(8): 1567 – 1580. (Abtract).

KUTTY, C. I. (1999). Gynaecological examination and pregnancy diagnosis in small ruminants using bimanual palpation technique: a review. *Theriogenology.* 51 (8): 1555 -1564.

LEETHONGDEE, S. and PONGLOWHAPAN, S. (2014). Artificial insemination in goats: An update. *Thai Journal of Veterinary Medicine*, 44 (Suppl. 1): 73-77.

MALAU-ADULI, A. E. O., ABUBAKAR, B. Y., EHOCHE, O. W. and DIM, N. I. (1996). Studies on milk production and growth for Friesian and Bunaji crosses. I. Dairy performance. *American Journal of Animal Science.* 9 (5): 503 - 308.

MEDAN, M., SHALABY, A. H., SHARAWY, S., WATANABE, G. and TAYA, K. (2002). Induction of estrus during non-breeding season in Egyptian Baladi goats. *Journal of Veterinary Medical Science.* **64**: 83 - 86. (Medline).

MOLOKWU, E. C. I. and IGONO, M. O. (1978). Reproductive performance and pattern in the Brown goat of the Nigerian Savannah zone. In: Proceedings of the 4th world

conference on animal production, Argentina, 578-590.

OGUNBIYI, P. O., MOLOKWU, E. C. I. and SOORIYAMOORTHY, R. (1980). Estrus synchronisation and controlled breeding in goats using prostaglandin PGF_2□. *Theriogenology,* 13(4):257-261.

OMONTESE, B. O., REKWOT, P. I., MAKUN, H. J., OBIDI, J. A., RWUAAN, J. S. and CHIEZEY, N. P. (2 0 1 0). Evaluation of EAZI-BREEDTM CIDR® and FGA-30® intravaginal sponges as synchronizing agents in Prepartum Sahel Does. *Journal of Veterinary Research* 3 (3): 64-69.

OMONTESE, B. O., REKWOT, P. I., MAKUN, H. J., ATE, I. U. and RWUAAN, J. S. (2012). In-duction of oestrus in Sahel goats using fluorogestone acetate (FGA) sponges and equine chorionic gonadotrophin (eCG). *Sokoto Journal Veterinary Science.* 10(2): 21-25.

OMONTESE, B.O., REKWOT, P.I., MAKUN, H.J., ATE, I.U., RWUAAN, J.S. and KAWU, M.U. (2013b). Oestrus induction using fluorogestone acetate sponges and equine chorionic gonadotrophin in Red Sokoto goats. *South African Journal of Animal Science*, 43(1): 68-73.

OMONTESE, B. O., REKWOT, P. I., ATE, I. U., MAKUN, H. J. and RWUAAN, J. S. (2014) Oestrus behaviour and conception rates of Red Sokoto goats following treatment with equine chorionic gonadotrophin and prostaglandin PGF2a. *Nigerian Veterinary Journal,* 34(4): 906 - 911.

OMONTESE, B. O. (2015). Influence of buck exposure, progestagen treatment and season on reproductive responses in goat. *PhD Thesis,* Ahmadu Bello University, Zaria.

OTCHERE, A. M., ADAMU, D. ,V. UZA and J. O. AGWA (1993) (Editors). Strategies for improving livestock production for small scale farmers in Nigeria. *Proceedings of the Workshop on Livestock Systems Research Organized by FLDPCS, Kaduna., Nigeria.*

OYEDIPE, E. O., BUVANENDRAN, V. and EDUVIE, L. O. (1982). Some factors affecting the reproductive performance of the White Fulani (Bunaji) cattle. *Tropical Agriculture (Trinidad).* 59: 231 - 234.

OZUNG, P. O., NSA, E. E., EBEGBULEM, V. N. and UBUA, J. A. (2011). The potentials of small ruminant production in Cross-River rain forest zone of Nigeria. A review: *Continental Journal of Animal and Veterinary Research*, 3 (1): 33 – 37.

PIERSON, J. T., BALDASSARRE, H., KEEFER, C. L. and DOWNEY, B. R. (2001). Seasonal variation in preovulatory events associated with synchronisation of estrus in dwarf goats. *Theriogenology,* 56: 759 - 769. (Medline).

PULLAN, N. V. (1978). "Condition scoring of White Fulani cattle", *Tropical Animal* ***Health*** *and Production*. 10: 118 – 120.

RESOURCE INVENTORY AND MANAGEMENT (RIM), (1992). Nigerian livestock resources. *Resource Inventory and Management (RIM) Ltd.* Volume II.

SMITH, J. F. (1995). Artificial insemination in dairy goats: Goat Breeding: *Artificial Insemination versus Natural Breeding*.

Goatworld (© 1999-2008 Goatworld.com). http://www.goatworld.com

STATISTICAL ANALYSIS SYSTEM (SAS), (1987). SAS User's guide: Statistics (5th edn.). *Statistical Analysis System Institute, Inc.*, Cary. NC.

ROMANO, J. E. (1996). Comparison of fluorogestone and medroxyprogesterone intravaginal pessaries for estrus synchronization in dairy goats. *Small Ruminant. Research*, 22, 219-223.

ROMANO, J. E. (1998). The effect of continuous presence of bucks on hastening the onset of estrus in synchronized does during the breeding season. *Small Ruminant. Research*, 30, 99-103.

ROMANO, J. E. (2002). Does in proestrusestrus hasten estrus onset in does synchronized during the breeding season. *Applied Animal Behavioural Science*, 77: 329-344.

VOH JR, A. A.. (1996). Fertility and embryonic mortality rates of Zebu cows following oestrus synchronization and artificial insemination. *Ph.D. Thesis*, Ahmadu Bello University Zaria, Nigeria.

VOH JR, A. A.., ABUBAKAR, I. U., REKWOT, P. I., LAKPINI, C. A. M., JATAU, J. D. and PEWAR, P. F. (2003). Oestrus synchronisation in goats: I. Oestrus response, pregnancy and kidding in Red Sokoto goats following treatment with prostaglandin F_2-alpha (PGF2-alpha) and natural service. *NAPRI Seminar*, 18 November 2003.

WHITLEY, N. C. and JACKSON, D. J. (2004) An update on estrus synchronization in goats: A minor species. *Journal of Animal Science*, 82: 270-276.

WILDEUS, S. (1999). Current concepts in synchronisation of estrus: Sheep and goats. *Proceedings of America Society Animal Science. Available:* http://www.asas.org/JAS/Symposia/proceedings/0016.pdf. accessed September 14, 2007, at 6:50pm

WILDEUS, S. (2000). Current concepts in synchronisation of oestrus: sheep and goats. *Journal of Animal Science*, 77: 1-14.

WILDEUS, S. (2008). Reproductrive management of the meat goat Goatwolrd (©1999-2008Goatworld.com). http://www.Goatworld.com